Commentary: Retinal hemodynamics, retrobulbar circulation and the use of color doppler imaging

Retrobulbar circulation has been of significant interest over decades, to help understand the pathophysiology of many ocular conditions. It is typically measured using the ultrasound-based color doppler imaging (CDI), in ophthalmic artery (OA), central retinal artery (CRA). and posterior ciliary arteries (PCA). Broadly, it has been found to be decreased in conditions like age-related macular degeneration (AMD), diabetic retinopathy (DR), glaucoma, myopia, retinitis pigmentosa, and increased in thyroid eye disease, ocular tumors, such as Retinoblastoma.[1] It also helps elucidate changes in circulation following interventions, for example, intra-arterial chemotherapy for retinoblastoma, where the flow reduced post therapy. Further CDI has also helped in finding and comparing changes in retrobulbar circulation postintravitreal antiVEGF and steroid injections. Adding to this current knowledge, as per the current study, reduction in flow in early DR has been found to be significantly more than severe DR which may be useful to predict the risk of progression of DR.[2]

However, the practical limitation of CDI may preclude its wide-scale use. While CDI is capable of detecting and characterizing vascularity, it requires significant expertise and involves a long learning curve. Since doppler imaging involves detecting a frequency shift caused by flowing blood in vessels, which in the eye are of very small calibre, a high sensitivity is required while keeping the signals resulting in artifacts at bay. In addition, to get a reliable waveform, parameters such as the angle of insonation and sample volume need to be optimally adjusted. Measurements typically used, that is, peak systolic velocity, end diastolic velocity, resistivity index, and pulsatility index would be reliable only when Doppler parameters have been adjusted appropriately. Importantly, Doppler studies may take up to 10 min, and are very sensitive to patient movement, thus patient cooperation is paramount.

Retrobulbar circulation is closely correlated to retinal, choroidal, and optic nerve hemodynamics[3] Non-invasive, techniques of measuring retinal blood flow include - retinal function imager, laser Doppler velocimetry, Doppler OCT flowmeter, laser speckle contrast imager.[4] Combined with information from retinal oximetry and optical coherence tomography angiography imaging, these modalities provide substantial insight into retinal hemodynamics, and changes in retinal blood flow following interventions.[5]

As technology evolves, it will be interesting to see the role of imaging techniques in helping us understand hemodynamic pathophysiology of not only eye diseases, but also throw insights into systemic conditions like hypertension, diabetes as well. This may potentially yield information on therapeutic targets which are likely to influence our practice of medicine in the future.

Mayank Bansal, Krithika Rangarajan[1]

Department of Ophthalmology, Fortis Memorial Research Institute, Gurugram, Haryana, [1]Department of Radiology, Institute Rotary Cancer Hospital, All India Institute of Medical Sciences, New Delhi, India

Correspondence to: Dr. Mayank Bansal, Fortis Memorial Research Institute, Gurugram - 122 002, Haryana, India.
E-mail: drmayankbansal.md@gmail.com

References

1. Williamson TH, Harris A. Color doppler ultrasound imaging of the eye and orbit. Surv Ophthalmol 1996;40:255-67.
2. Divya K, Kanagaraju V, Devanand B, Jeevamala C, Raghuram A, Sundar D. Evaluation of retrobulbar circulation in type 2 diabetic patients using color Doppler imaging. Indian J Ophthalmol 2020;68:1108-14.
3. Pournaras CJ, Pournaras CJ, Riva CE. Retinal blood flow evaluation. Ophthalmologica 2013;229:61-74.
4. Grudzińska E, Modrzejewska M. Modern diagnostic techniques for the assessment of ocular blood flow in myopia: Current state of knowledge. Mrugacz M, editor. J Ophthalmol 2018;2018:4694789.
5. Hudson C, Rose K, Kulasekara S, Cheng R, Wong B. Retinal oximetry and blood flow. Acta Ophthalmol (Copenh) 2016;94. doi: 10.1111/j.1755-3768.2016.0149.

Access this article online

Quick Response Code:

Website: www.ijo.in

DOI: 10.4103/ijo.IJO_1378_20

Cite this article as: Bansal M, Rangarajan K. Commentary: Retinal hemodynamics, retrobulbar circulation and the use of color doppler imaging. Indian J Ophthalmol 2020;68:2623.